

LETTER / *Neuroradiology*

Retrograde cerebral venous air embolism: A rare cause of intracranial gas



Keywords: Venous air embolism; Gas intracranial; Ablation of venous catheter

The presence of intracranial gas in a traumatic context first suggests a fracture of the vault or base of the skull. In rare cases, intracranial gas may be due to gas embolism. The authors present an exceptional case of retrograde cerebral venous air embolism following the ablation of a peripheral venous catheter.

Case report

The emergency department requested a head computed tomography (CT) without contrast media for a brain trauma (fall from height) in a 92-year-old female patient followed for Alzheimer's disease. The patient presented an acute confusional status but neurological examination was considered to be normal.

Head CT detected several intracranial bubbles of air density. They were mainly right-sided, at the contact of orbital fissure and jugular foramen (Fig. 1). A careful bone window examination was not able to identify any fracture of the vault or base of the skull. Analysis of the topography of the gas bubbles found them all within venous structures: right cavernous sinus and right inferior ophthalmic vein, left cavernous sinus and right sigmoid sinus.

Moreover, the CT technologist reported that the patient ripped out her peripheral venous catheter, inserted at the crook of her right elbow, immediately before the examination. The final diagnosis was therefore retrograde venous air embolism.

Discussion

Retrograde air embolism is a rare cause of intracranial venous gas. Several cases have been reported in the literature after handling, ablation or disconnection of a central venous catheter [1]. To our knowledge, no cases have been described incriminating a peripheral venous catheter.

The topography of intravascular gas embolism may be arterial or venous. The main causes of embolism are: iatrogenic, accidental and exceptionally suicide. In iatrogenic cases, the gas is most often introduced by venous catheter.

The gas most often follows the blood flow to the right heart cavities. Depending on the quantity of air introduced, gas may reach the arterial circulation by several mechanisms (forcing of the pulmonary filter, opening of right/left intra-pulmonary shunts, or permeable oval foramen). We then speak of paradoxical embolism [2].

In rarer cases, the intravenous gas may run through the veins in a direction opposite to that of the normal blood flow and reach the intracranial venous sinuses. In this situation, the term used is retrograde embolism. In the literature as in our patient, the cavernous sinuses are most often involved. Like ours, certain cases are asymptomatic. However, cases of cerebral venous infarction by gas embolism have been described where the clinical presentation consisted of seizures [3].

The possible circulation of gas carried in a direction opposite to that of the blood flow has been demonstrated experimentally [4,5]. An experimental model has shown that this is possible, provided that the patient is at least in a semi-seated position. In fact, gas can only surge back through the veins as of an angle of 45° to the horizontal. However, in vivo, other factors come into consideration. Venous valve insufficiency was incriminated by contrast-enhanced ultrasound [6]. Finally, like in paradoxical embolisms, retrograde venous embolism is favored by an increase in the pressure in the right cavities (Valsalva).

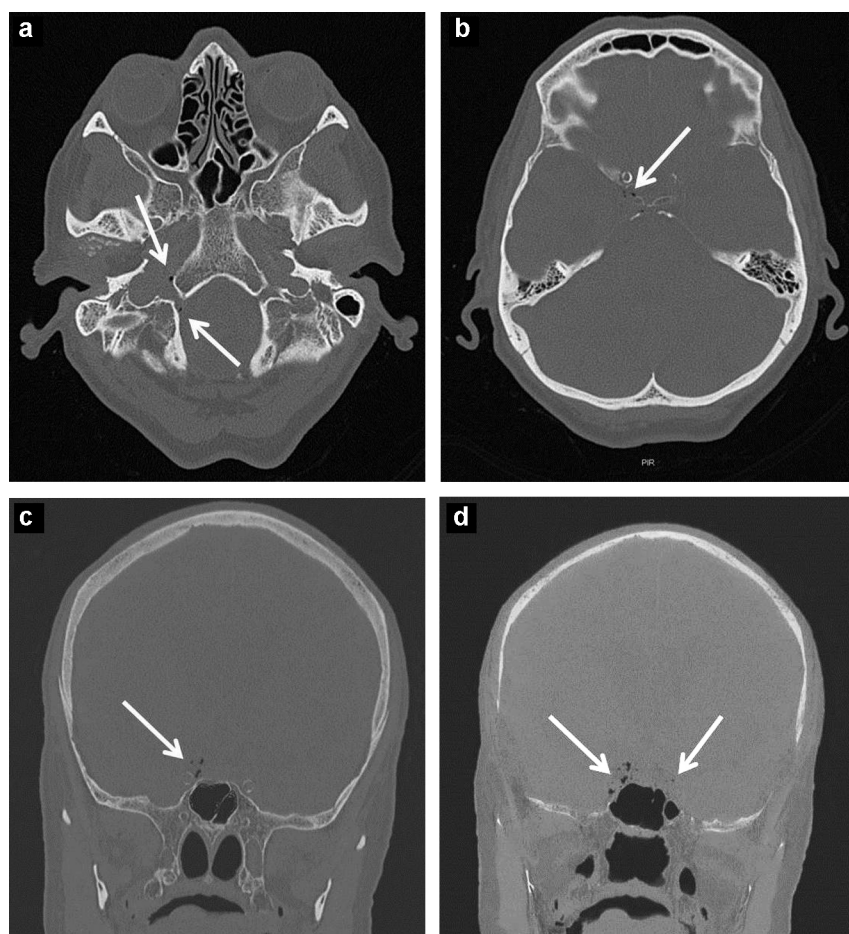


Figure 1. CT-scan and intracranial venous gas: a: axial section revealing the gas in the right sigmoid sinus; b: axial section revealing the gas in the right cavernous sinus; c: coronal section revealing the gas in the right cavernous sinus; d: coronal MinIP reconstruction revealing the gas in the cavernous sinuses.

Conclusion

Gas embolism is a possible cause of intracranial gas and should be considered, especially if a skull fracture is not visible.

A retrograde venous embolism, although rare, should be considered when the topography of the bubbles is compatible with the venous gas, and a venous catheter, even peripheral, has recently been handled.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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